

(12) **United States Patent**  
**Lee**

(10) **Patent No.:** **US 9,195,357 B2**  
(45) **Date of Patent:** **Nov. 24, 2015**

(54) **SYSTEM FOR PROVIDING A USER INTERFACE FOR USE BY PORTABLE AND OTHER DEVICES**

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(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/026,404**

(22) Filed: **Sep. 13, 2013**

(65) **Prior Publication Data**

US 2014/0085259 A1 Mar. 27, 2014

(30) **Foreign Application Priority Data**

Sep. 25, 2012 (KR) ..... 10-2012-0106793

(51) **Int. Cl.**  
**G06F 3/044** (2006.01)  
**G06F 3/0488** (2013.01)

(52) **U.S. Cl.**  
CPC ..... **G06F 3/044** (2013.01); **G06F 3/0488**  
(2013.01); **G06F 3/04883** (2013.01); **G06F**  
**2203/04808** (2013.01)

(58) **Field of Classification Search**

CPC ..... G06F 3/0488; G06F 3/016; G06F  
2203/04108; G06F 3/0412; G06F 2203/04809;  
G06F 3/017; G06F 3/03545; G06F 3/0487;  
G06F 17/217; G06F 17/241; G06F 17/242;  
G06F 17/276; G06F 3/0416; G06F 3/04883  
USPC ..... 345/156, 173-179, 661, 676;  
178/18.01-18.09; 715/200; 463/37-38  
See application file for complete search history.

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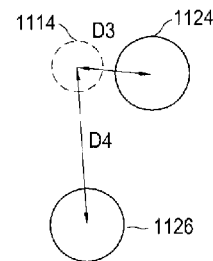
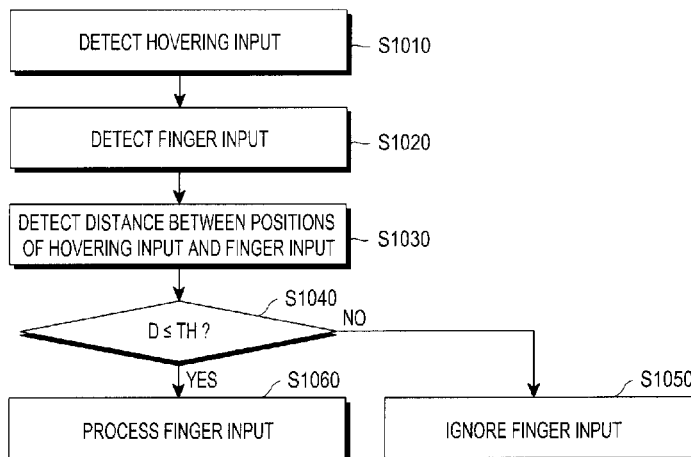
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(57) **ABSTRACT**

A method of processing a touch input of a portable terminal includes detecting a hover input, detecting a finger input while receiving the hover input, calculating a distance between positions of the hover input and the finger input, comparing the calculated distance with a predetermined threshold and ignoring or processing the finger input according to a result of the comparison.

**7 Claims, 9 Drawing Sheets**



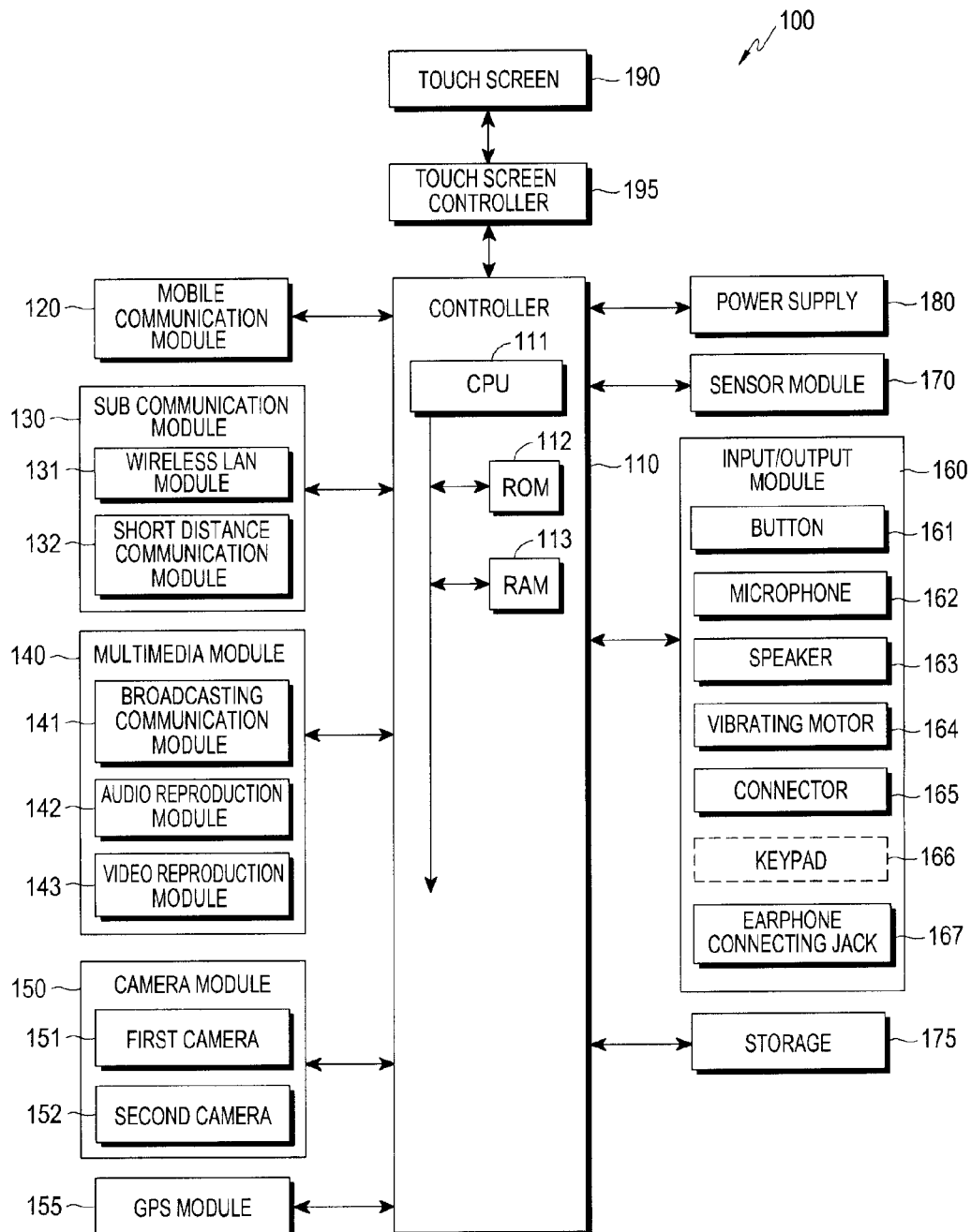


FIG. 1

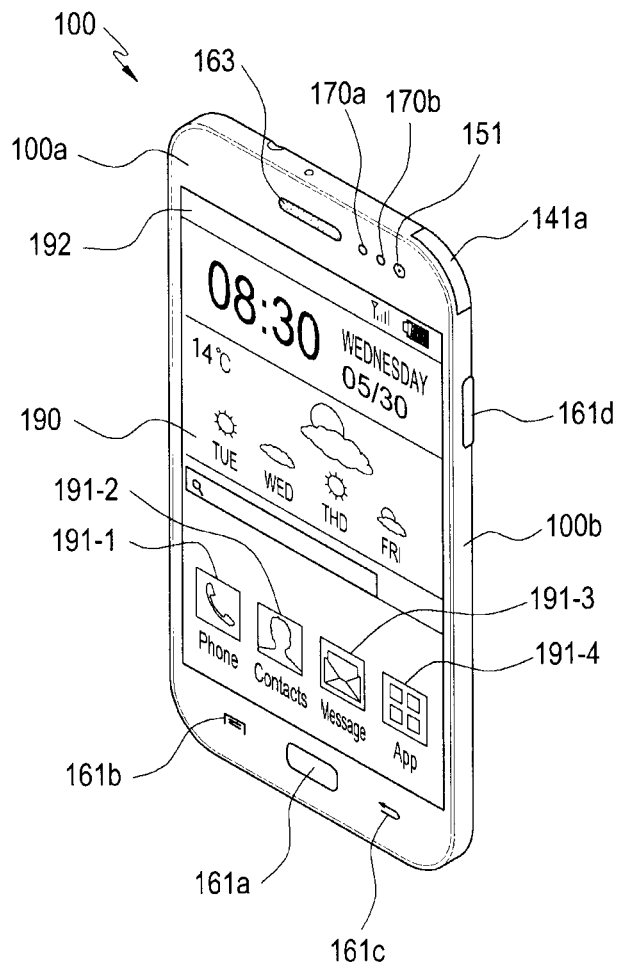


FIG. 2

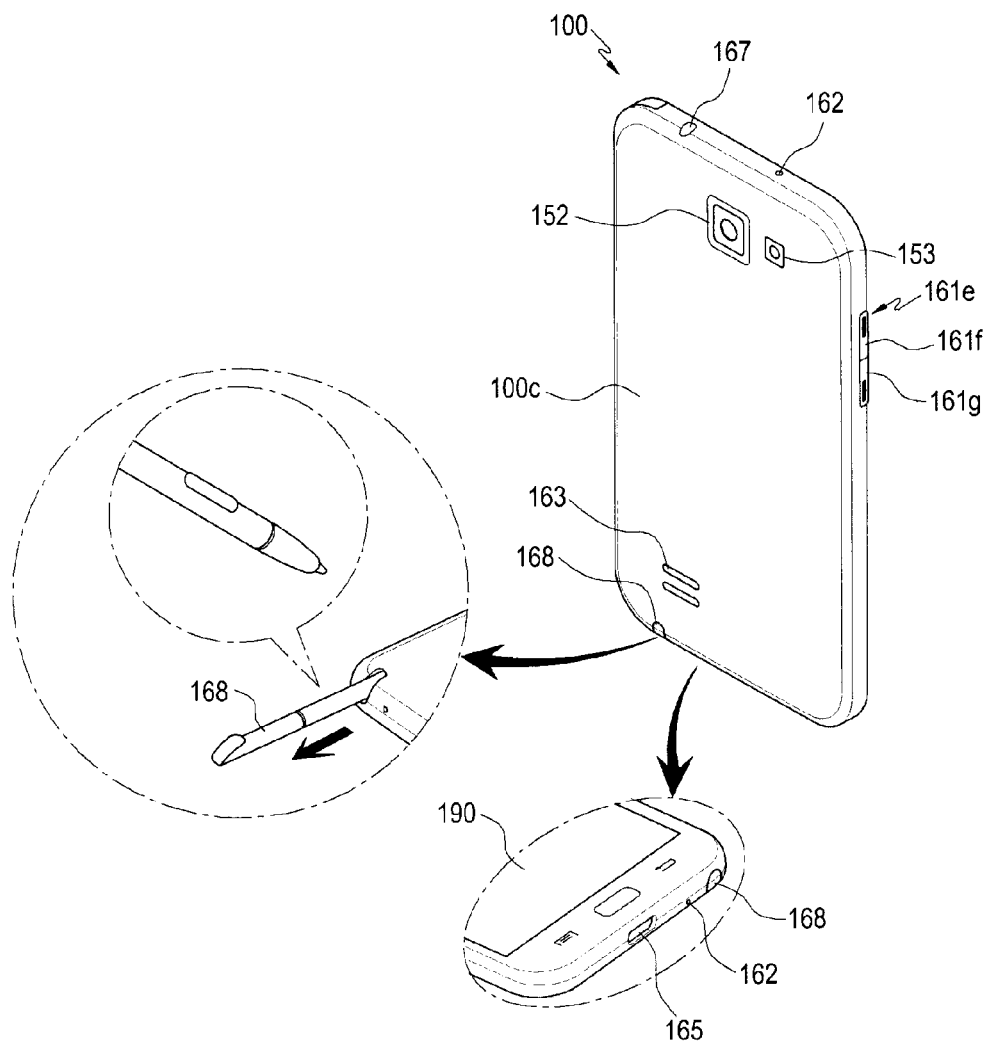


FIG.3

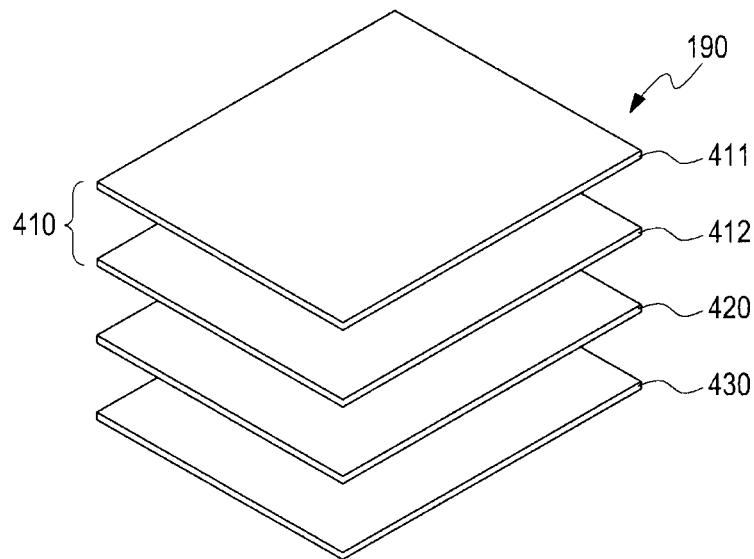


FIG.4

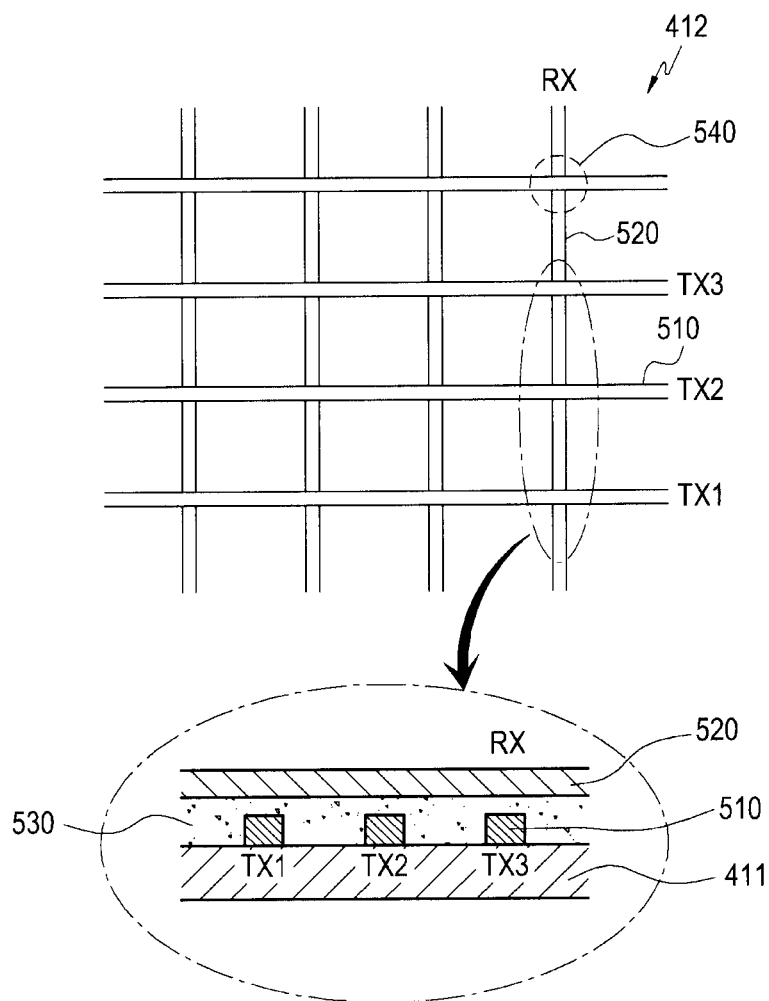


FIG.5

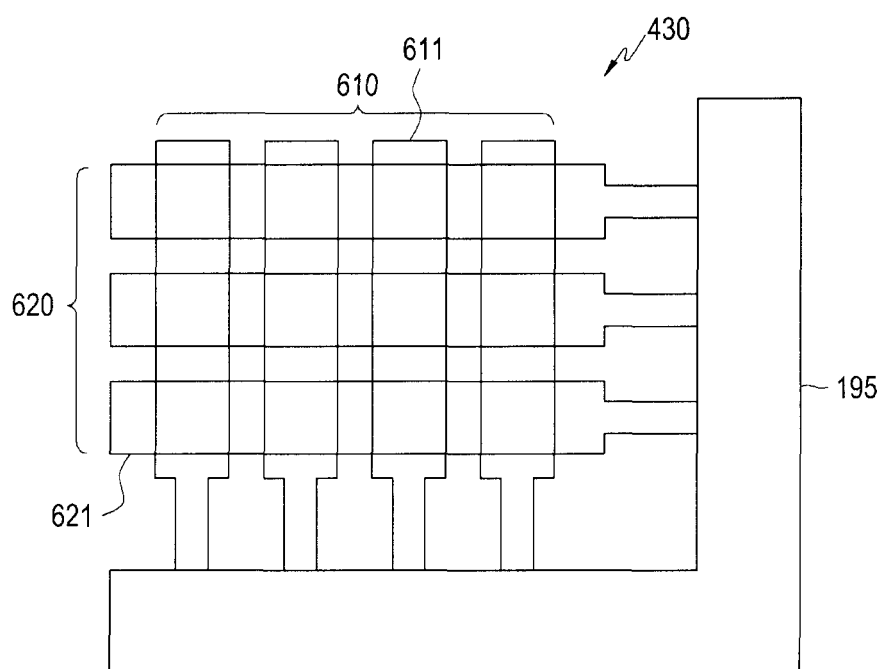


FIG.6

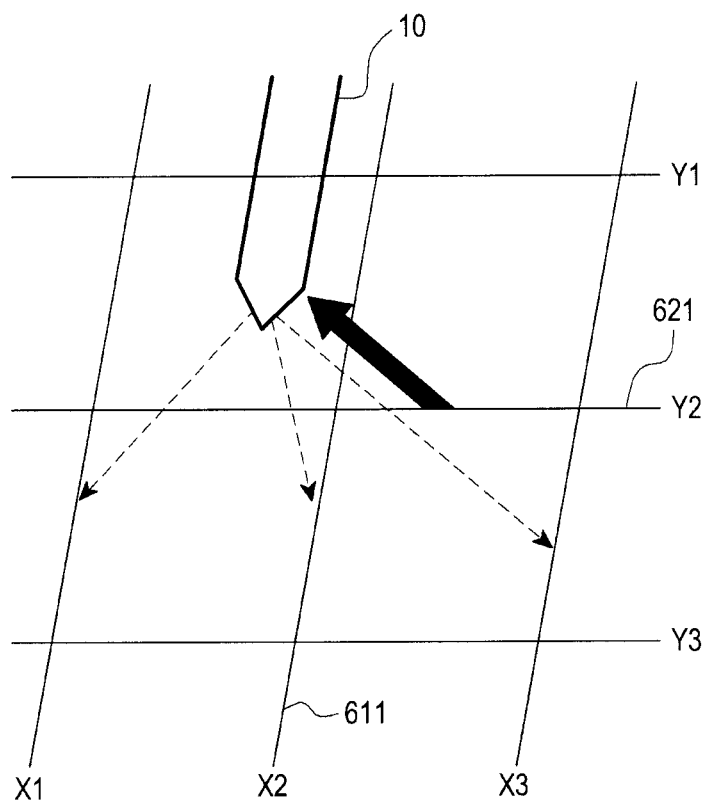


FIG. 7



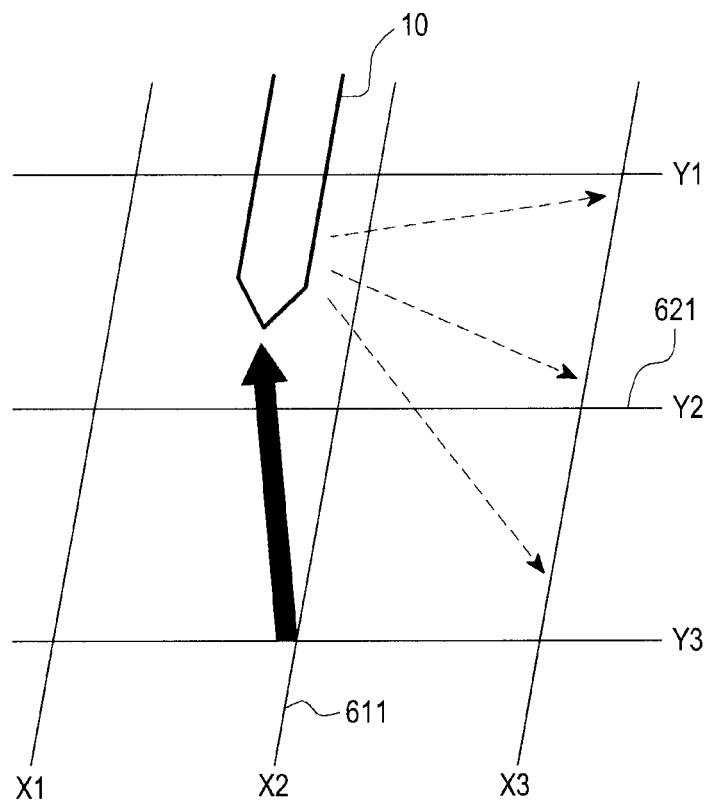


FIG. 8

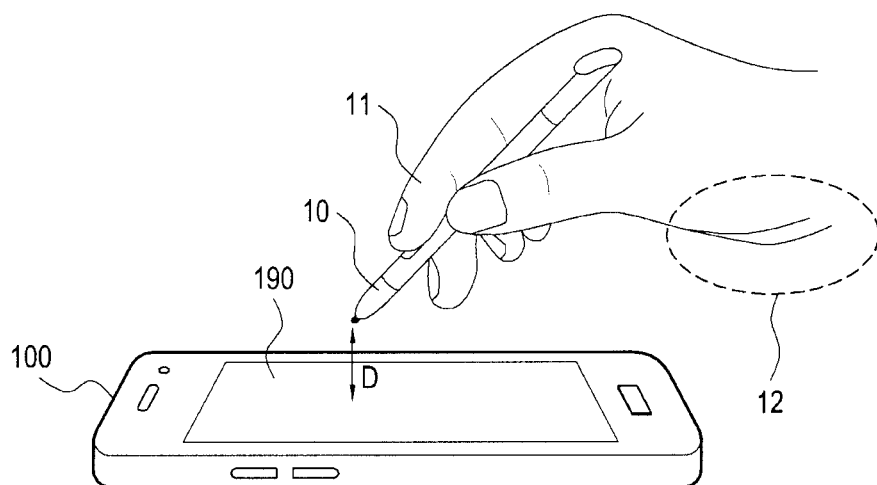


FIG. 9

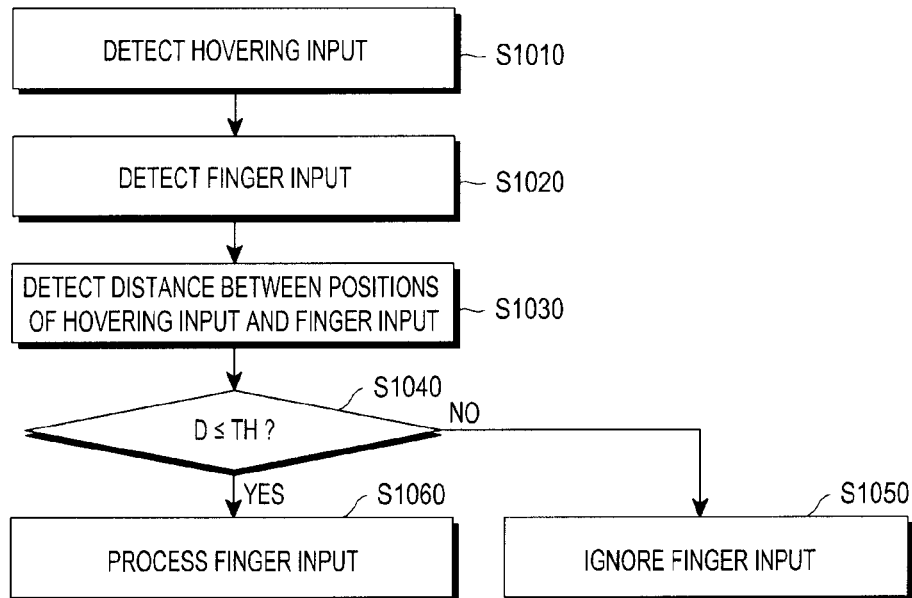


FIG.10

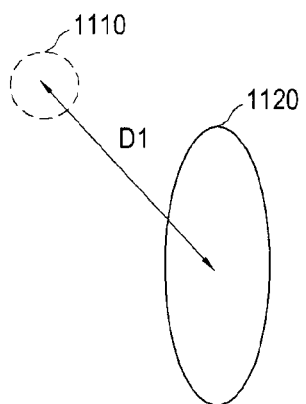


FIG.11A

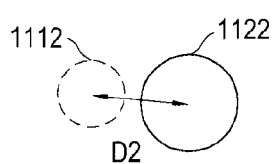


FIG.11B

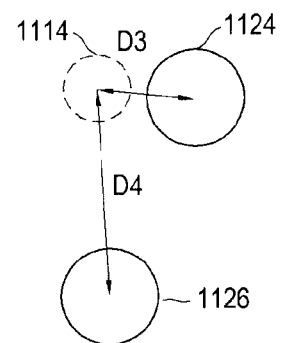


FIG.11C

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## SYSTEM FOR PROVIDING A USER INTERFACE FOR USE BY PORTABLE AND OTHER DEVICES

### CROSS RELATED APPLICATION

This application claims the priority under 35 U.S.C. §119 (a) from Korean Application Serial No. 10-2012-0106793, which was filed in the Korean Intellectual Property Office on Sep. 25, 2012, the entire content of which is hereby incorporated by reference.

### BACKGROUND

#### 1. Field of the Invention

The present disclosure relates to a user interface of a portable or other processing device such as a phone, notebook or computer, for processing input commands by finger, stylus (e.g. a stylus) and other devices via a touch screen.

#### 2. Description of the Related Art

A portable device (a mobile terminal such as a phone, notebook, computer, and watch for example) typically includes a touch screen for receiving user input. A touch screen is used to distinguishably detect a finger input or the like and a stylus (stylus) input. The touch screen typically prioritizes a stylus input so that when there is a stylus input, the touch screen ignores a finger input to prevent malfunction associated with an inadvertent palm touch. However, where a user performs a finger touch while grasping a stylus, since a recognition distance of a stylus is relatively large, the finger touch is sometimes ignored, which may be recognized as a malfunction of the touch screen and cause problems. A system according to invention principles addresses this deficiency and related problems.

### SUMMARY

A user interface system according to invention principles supports processing concurrent finger input and the stylus input commands in accordance with an intention of the user. The system detects a hover input command, detects a finger input command concurrently with the hover input command, calculates a distance between positions of the hover input command and finger input command, compares the calculated distance with a predetermined threshold and at least one of, ignores and processes the finger input command in response to a result of the comparison.

A portable terminal includes a machine-readable storage medium including a program executable by a processor for processing a touch input command. The portable terminal comprises a touch screen that displays input data and detects a hover input command and a finger input command. A controller calculates a distance between positions of the hover input command and the finger input command when the finger input is detected concurrently with the hover input command, compares the calculated distance with a predetermined threshold and ignores or processes the finger input command in response to a result of the comparison.

### BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features, and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a block diagram schematically illustrating a portable terminal according to invention principles;

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FIG. 2 is a front perspective view of a portable terminal according to invention principles;

FIG. 3 is a rear perspective view of a portable terminal according to invention principles;

FIG. 4 is a perspective view separately showing main components of a touch screen according to invention principles;

FIG. 5 is a diagram illustrating an example of a pattern of a sensor layer according to invention principles;

FIG. 6 is a diagram for describing a second touch panel according to invention principles;

FIGS. 7 and 8 are diagrams for describing a method of detecting a stylus input position according to invention principles;

FIG. 9 is a diagram for describing a hovering input according to invention principles;

FIG. 10 is a flowchart illustrating a method of processing a multi-touch according to invention principles; and

FIGS. 11A, 11B and 11C are diagrams for describing a process of calculating a distance between a hovering input position and a finger input position according to invention principles.

### DETAILED DESCRIPTION

The present invention may have various modifications and embodiments and thus will be described with reference to specific embodiments in detail. However, the present invention is not limited to the specific embodiments but should be construed as including all modifications, equivalents, and substitutes within the spirit and scope of the present invention.

While terms including ordinal numbers, such as “first” and “second,” etc., may be used to describe various components, such components are not limited by the above terms. The above terms are used only to distinguish one component from another. For example, a first component may be referred to as a second component without departing from the scope of the present invention, and likewise a second component may be referred to as a first component. The term of and/or encompasses a combination of plural items or any one of the plural items.

The terms used herein are merely used to describe specific embodiments, and are not intended to limit the present invention. An expression used in the singular encompasses the expression of the plural, unless it has a clearly different meaning in the context. The terms such as “include” and/or “have” may be construed to denote a certain characteristic, number, step, operation, constituent element, component or a combination thereof, but may not be construed to exclude the existence of or a possibility of addition of one or more other characteristics, numbers, steps, operations, constituent elements, components or combinations thereof.

Unless defined otherwise, all terms used herein have the same meaning as commonly understood by those of skill in the art. Such terms as those defined in a generally used dictionary are to be interpreted to have the meanings equal to the contextual meanings in the relevant field of art, and are not to be interpreted to have ideal or excessively formal meanings unless clearly defined in the present specification. No claim element herein is to be construed under the provisions of 35 U.S.C. 112, sixth paragraph, unless the element is expressly recited using the phrase “means for”. A stylus as used herein comprises a pointed instrument used as an input device on a touch screen or pressure-sensitive screen and may comprise a pen, writing instrument, or other hand held pointing instrument.

FIG. 1 shows a block diagram schematically illustrating a portable terminal according to an embodiment of the present invention, FIG. 2 is a front perspective view of a portable terminal according to an embodiment of the present invention, and FIG. 3 is a rear perspective view of a portable terminal according to an embodiment of the present invention.

Referring to FIG. 1, a portable terminal 100 may be connected with an external device (not shown) by using an external device connector such as a sub communication module 130, a connector 165, and an earphone connecting jack 167. The external device includes various devices attached to or detached from the portable terminal 100 through a cable, such as an earphone, an external speaker, a Universal Serial Bus (USB) memory, a charger, a cradle/dock, a DMB (Digital Multimedia Broadcasting) antenna, a mobile payment related device, a health management device (blood sugar tester, for example), a game machine, a car navigation device, for example. Further, the external device includes a Bluetooth communication device, a short distance communication device such as a Near Field Communication (NFC) device, a WiFi Direct communication device, and a wireless Access Point (AP) which may be wirelessly connected. In addition, the external device may include another device, a mobile phone, a smart phone, a tablet PC, a desktop PC, and a server.

The portable terminal 100 may comprise a smart phone, a mobile phone, a game machine, a TV, a display device, a head unit for a vehicle, a notebook, a laptop, a tablet PC, a Personal Media Player (PMP), a Personal Digital Assistant (PDA) or a watch, for example. The portable terminal 100 may be implemented as a pocket size portable mobile terminal having a wireless communication function.

The portable terminal 100 includes a touch screen 190 and a touch screen controller 195. Further, the portable terminal 100 includes a controller 110, a mobile communication module 120, a sub communication module 130, a multimedia module 140, a camera module 150, a GPS module 155, an input/output module 160, a sensor module 170, a storage unit 175, and a power supplier 180. The sub communication module 130 includes at least one of a wireless LAN module 131 and a short distance communication module 132, and the multimedia module 140 includes at least one of a broadcasting communication module 141, an audio reproduction module 142, and a video reproduction module 143. The camera module 150 includes at least one of a first camera 151 and a second camera 152. The input/output module 160 includes at least one of a button 161, a microphone 162, a speaker 163, a vibration motor 164, a connector 165, a keypad 166, and an earphone connecting jack 167.

The controller 110 includes a CPU 111, a ROM 112 storing a control program for controlling the portable terminal 100, and a RAM 113 used as a storage area for storing a signal or data input from the outside of the apparatus 100 or for work performed in the portable terminal 100. The CPU 111 includes a single core, a dual core, a triple core, a quad core or comprises another architecture. The CPU 111, the ROM 112, and the RAM 113 may be mutually connected to each other through an internal bus. The controller 110 controls the mobile communication module 120, the sub communication module 130, the multimedia module 140, the camera module 150, the GPS module 155, the input/output module 160, the sensor module 170, the storage unit 175, the power supplier 180, the touch screen 190, and the touch screen controller 195.

The mobile communication module 120, the sub communication module 130, and the broadcasting communication module 141 of the multimedia module 140 may be collec-

tively called a communication unit, and the communication unit is provided for a direct connection with an external device or a connection through a network and may be a wired or wireless communication unit. The communication unit can transmit data to the controller 110, the storage unit 175, and the camera module 150 in a wired manner or wirelessly, or receive data from an external communication line or the air and transmit the data to the controller 110 or store the data in the storage unit 175.

The mobile communication module 120 enables the portable terminal 100 to be connected with the external device through mobile communication by using one antenna or a plurality of antennas according to a control of the controller 110. The mobile communication module 120 transmits or receives a wireless signal for exchanging, unidirectionally transmitting, or receiving data of voice phone communication, video phone communication, a Short Message Service (SMS), or a Multimedia Message Service (MMS) to/from a mobile phone (not shown), a smart phone (not shown), a tablet PC, or another device (not shown) having a phone number input into the apparatus 100.

The sub communication module 130 may include at least one of the wireless LAN module 131 and the short distance communication module 132. For example, the sub communication module 130 may include just the wireless LAN module 131, just the near field communication module 132, or both the wireless LAN module 131 and the near field communication module 132.

The wireless LAN module 131 may be Internet-connected according to a control of the controller 110 in a place where a wireless Access Point (AP) (not shown) is installed. The wireless LAN module 131 supports a wireless LAN standard (IEEE802.11x) of the Institute of Electrical and Electronics Engineers. The short distance communication module 132 wirelessly performs near field communication between the portable terminal 100 and an image forming apparatus (not shown) in response to control of the controller 110. A short distance communication method includes Bluetooth, Infrared Data Association (IrDA) communication, WiFi-Direct communication and Near Field Communication (NFC), for example.

The portable terminal 100 may include at least one of the mobile communication module 120, the wireless LAN module 131, and the short distance communication module 132. For example, the portable terminal 100 may include a combination of the mobile communication module 120, the wireless LAN module 131, and the short distance communication module 132.

The multimedia module 140 includes the broadcasting communication module 141, the audio reproduction module 142, or the video reproduction module 143. The broadcasting communication module 141 receives a broadcasting signal (for example, a TV broadcasting signal, a radio broadcasting signal, or a data broadcasting signal) and broadcasting supplemental information (for example, Electric Program Guide: EPG or Electric Service Guide: ESG) output from a broadcasting station through a broadcasting communication antenna (not shown) in response to control of the controller 110. The audio reproduction module 142 reproduces a digital audio file (for example, a file having a file extension of mp3, wma, ogg, or wav) stored or received in response to control of the controller 110. The video reproduction module 143 reproduces a digital video file (for example, a file having a file extension of mpeg, mpg, mp4, avi, mov, or mkv) stored or received in response to a control of the controller 110. The video reproduction module 143 reproduces the digital audio file.

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The multimedia module **140** includes the audio reproduction module **142** or the video reproduction module **143** except for the broadcasting communication module **141**. Further, the audio reproduction module **142** or the video reproduction module **143** of the multimedia module **140** may be included in the controller **110**.

The camera module **150** includes at least one of the first camera **151** and the second camera **152** for photographing a still image or a video according to a control of the controller **110**. Further, the first camera **151** or the second camera **152** includes an auxiliary light source (for example, a flash (not shown) providing light required for the photographing. The first camera **151** may be disposed on a front surface of the apparatus **100**, and the second camera **152** may be disposed on a back surface of the apparatus **100**. Alternatively, the first camera **151** and the second camera **152** may be closely located to each other (for example, an interval between the first camera **151** and the second camera **152** is larger than 1 cm and smaller than 8 cm) and acquire a three dimensional still image or a three dimensional video.

The cameras **151** and **152** include a lens system, an image sensor and a flash source, for example. The cameras **151** and **152** convert an optical signal input (or photographed) through the lens system to an image signal and output the converted image signal to the controller **110**. The user acquires a video or a still image through the cameras **151** and **152**. The lens system forms an image of a subject by converging a light incident from the outside. The lens system includes at least one lens and each lens may be a convex lens and an aspheric lens, for example. The lens system has symmetry with respect to an optical axis passing through the center thereof, and the optical axis is defined as a center axis. The image sensor detects the optical image formed by the external light incident through the lens system as an electrical image signal. The image sensor has a plurality of pixel units placed in an M×N matrix structure and includes a photodiode and a plurality of transistors. The pixel unit accumulates charges generated by the incident light, and a voltage derived from accumulated charges indicates luminance of incident light. In processing one image included in a still image or a video, the image signal output from the image sensor consists of a set of voltages (that is, pixel values) output from the pixel units and the image signal indicates one frame (that is, a still image). Further, a frame comprises M×N pixels. The image sensor includes a Charge-Coupled Device (CCD) image sensor, a Complementary Metal-Oxide Semiconductor (CMOS) image sensor, for example.

A driver drives the image sensor according to a control of the controller **110**. The driver drives entire pixels of the image sensor or pixels in an area of interest comprising a subset of the entire pixels in response to a control signal received from the controller **110** and image data output from the pixels is output to the controller **110**.

The controller **110** processes the image input from the cameras **151** and **152** or the image stored in the storage unit **175** as frames and outputs an image frame converted to be suitable for screen characteristics (size, picture quality, resolution, for example) of the touch screen **190**.

The GPS module **155** receives radio waves from a plurality of GPS satellites (not shown) in Earth's orbit and calculate a position of the portable terminal **100** by using Time of Arrival from the GPS satellites to the portable terminal **100**.

The input/output module **160** includes at least one of, the button **161**, the microphone **162**, the speaker **163**, the vibration motor **164**, the connector **165**, and the keypad **166**. The input/output module **160** except for the connector **165** is used for receiving a user input or informing the user of informa-

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tion. Other examples of the input/output module **160** are not limited thereto, but a mouse, a trackball, a joystick, or a cursor control such as cursor direction keys may be provided for information communication with the controller **110** and a control of a motion of the cursor on the touch screen **190**.

The button **161** may be formed on a front surface **100a**, a side surface **100b**, or a back surface **100c** (FIG. 3) of the portable terminal **100**, and may include at least one of a power button **161d**, volume buttons **161e** having a volume increase button **161f** and a volume decrease button **161g**, a menu button **161b**, a home button **161a**, a back button **161c**, and a search button.

The microphone **162** receives a voice or a sound to generate an electrical signal in response to a control of the controller **110**.

The speaker **163** outputs sounds corresponding to various signals (for example, a wireless signal, a broadcasting signal, a digital audio file, a digital video file, taking a picture, for example) of the mobile communication module **120**, the sub communication module **130**, the multimedia module **140**, or the camera module **150** to the outside of the portable terminal **100**, in response to a control of the controller **110**. The speaker **163** outputs a sound (for example, button tone corresponding to phone communication, ringing tone, and a voice of another user) corresponding to a function performed by the portable terminal **100**. One speaker **163** or a plurality of speakers **163** may be formed on a suitable position or positions of the housing of the portable terminal **100**.

The vibration motor **164** converts an electrical signal to a mechanical vibration in response to control of the controller **110**. For example, when portable terminal **100** in a vibration mode receives voice or video phone communication from another device (not shown), a vibration motor is operated. One vibration motor **164** or a plurality of vibration motors **164** may be formed within the housing of the portable terminal **100**. The vibration motor operates in accordance with a touch action of the user on the touch screen or successive touch motions or a gesture on the touch screen **190**.

The connector **165** may be used as an interface for connecting the apparatus with an external device (not shown) or a power source (not shown). The portable terminal **100** transmits or receives data stored in the storage unit **175** of the apparatus **100** to or from an external device (not shown) through a wired cable connected to the connector **165** in response to control of the controller **110**. The external device may be a docking station, and the data may be an input signal transmitted from an external input device, for example, a mouse or a keyboard. The portable terminal **100** receives power from the power source through the wired cable connected to the connector **165** and charges a battery (not shown) using the power source.

The keypad **166** receives a key input from the user for the control of the portable terminal **100**. The keypad **166** includes a physical keypad (not shown) formed in the portable terminal **100** or a virtual keypad (not shown) displayed on the display unit **190**. The physical keypad (not shown) formed in the portable terminal **100** may be excluded in response to a capability or structure of the portable terminal **100**.

An earphone (not shown) is inserted into the earphone connecting jack **167** to be connected with portable terminal **100**.

The sensor module **170** includes at least one sensor for detecting a state (position, direction and motion, for example) of the portable terminal **100**. For example, the sensor module **170** includes at least one of a proximity sensor for detecting whether a user approaches the portable terminal **100**, an illumination sensor (not shown) for detecting an amount of ambi-

ent light of the portable terminal **100**, a motion/direction sensor for detecting motions of the portable terminal **100** (for example, rotation, acceleration, retardation, vibration of the portable terminal **100**), and an altimeter for measuring an atmospheric pressure to detect an altitude. Further, the motion/direction sensor may include an acceleration sensor, a geo-magnetic sensor (not shown) for detecting a point of the compass by using the Earth's magnetic field, a gravity sensor for detecting a gravity action direction, a gyro sensor, an impact sensor, a GPS and a compass sensor, for example. At least one sensor detects a state, generates a signal corresponding to the detection, and transmits the signal to the controller **110**. The sensors of the sensor module **170** may be present or omitted from portable terminal **100**.

The storage unit **175** stores a signal or data input/output in response to the operation of the communication module **120**, the sub communication module **130**, the multimedia module **140**, the camera module **150**, the GPS module **155**, the input/output module **160**, the sensor module **170**, or the touch screen **190**. The storage unit **175** stores a control program and applications for controlling the portable terminal **100** or the controller **110**. The term "storage unit" is used to refer to a random data storage device such as the storage unit **175**, the ROM **112** and the RAM **113** within the controller **110**, or a memory card (for example, an SD card or a memory stick) installed in the portable terminal **100**.

The storage unit **175** stores images for providing applications having various functions such as navigation, a video phone call, a game for example and Graphical User Interfaces (GUIs) related to the applications, databases related to a method of providing user information, a document, and the user interface, data, background images (menu screen, standby screen for example) required for driving the portable terminal **100**, operating programs, or images acquired by the camera. The storage unit **175** is a machine-readable storage medium (readable by a computer, for example), and a machine-readable medium is defined herein as a medium for providing data to a machine to perform a specific function. The storage unit **175** includes a non-volatile medium and a volatile medium. Such media or of a type enabling commands transmitted from, or stored by, the media are detectable by a physical device in a machine reading the commands.

The machine-readable medium includes at least one of a floppy disk, a flexible disk, a hard disk, a magnetic tape, a Compact Disk Read-Only Memory (CD-ROM), an optical disk, a punch card, a paper tape, a Read-Only Memory (RAM), a Programmable ROM (PROM), an Erasable PROM (EPROM), and a flash-EPROM, for example.

The power supplier **180** supplies power to a battery or a plurality of batteries (not shown) in the portable terminal **100** in response to a control of the controller **110**. The battery or the plurality of batteries (not shown) supply power to the portable terminal **100**. Further, the power supply **180** provides power input from an external power source (not shown) to the portable terminal **100** through a wired cable connected to the connector **165**. In addition, the power supply **180** supplies power wirelessly input from an external power source to the portable terminal **100** through a wireless charging unit.

The touch screen **190** provides user interface display images corresponding to various services (for example, phone communication, data transmission, broadcasting, and photography) to the user. The touch screen **190** transmits an analog signal corresponding to at least one touch input to the user interface via the touch screen controller **195**. The touch screen **190** receives at least one touch through a touch system (for example, a finger or a stylus). Further, the touch screen **190** can receive successive touch motions or a gesture as input

commands. The touch screen **190** transmits an analog (or digital) signal corresponding to the successive motions of the input touch to the touch screen controller **195**.

Further, a stylus **168** may be formed in a lower side surface of the portable terminal **100**. The stylus **168** may be stored while being inserted into the portable terminal and may be withdrawn and removed from the portable terminal **100** when being used. In addition, a stylus attachment/detachment switch (not shown) operating in accordance with attachment and detachment of the stylus **168** is located in one area with in the portable terminal into which the stylus **168** is inserted and provides a signal corresponding to the attachment and detachment of the stylus **168** to the controller **110**.

Furthermore, a touch is not limited to be between the touch screen **190** and a touch element (a finger or a stylus) and may include a non-contact (for example, a case where a physical distance interval between the touch screen **190** and the touch element is 1 cm or shorter). A detection threshold interval of the touch screen **190** may be changed in response to configuration information or structure of the portable terminal **100**. Particularly, the touch screen **190** changes an output value in response to an interval between the touch screen **190** and the touch element such that a touch event between the touch screen **190** and the touch element and an input (for example, hovering) event in a non-contact state are distinguishably detected. That is, the touch screen **190** is implemented to process a value (for example, a current value, a voltage value, a capacitance value) detected by the touch event in a different manner than a value detected by the hovering event.

The touch screen controller **195** converts an analog signal received from the touch screen **190** to a digital signal (for example, (X,Y) coordinates and a detection value) and transmits the converted digital signal to the controller **110**. The controller **110** controls the touch screen **190** using the digital signal received from the touch screen controller **195**. For example, the controller **110** allows a short-cut icon displayed on the touch screen **190** to be executed in response to a touch event or a hovering event. In one embodiment, the touch screen controller **195** is included in the controller **110** or the touch screen **190**.

Further, the touch screen controller **195** calculates a distance between the touch element and the touch screen **190** based on a value output from the touch screen **190**, and converts the calculated distance value to a digital signal (for example, a Z coordinate) and provides the converted digital signal to the controller **110**.

Moreover, the touch screen controller **190** determines whether the user input element (e.g., a stylus) and the touch screen **190** contact each other based on the value output from the touch screen **190**, converts the value indicating whether the user input element and the touch screen **190** contact each other to a digital signal, and provides the digital signal to the controller **110**. In addition, in order to distinguishably detect an input by a finger and an input by a stylus, the touch screen **190** includes at least two touch screen panels which detect the input by the finger and the input by the stylus, respectively. The at least two touch screen panels provide different output values to the touch screen controller **195**, and the touch screen controller **195** recognizes and distinguishes the values input from the at least two touch screen panels to determine whether the input from the touch screen **190** is the input by the finger or the stylus. For example, the touch screen **190** in an embodiment has a structure in which one touch screen panel is a capacitive type and another touch screen panel is an Electromagnetic Resonance (EMR) type used in combination. Further, as described above, the touch screen may include touch keys such as the menu button **161b**, the back

button **161c** and accordingly, a finger input includes a touch input on the touch key as well as a finger input on the touch screen **190**.

Referring to FIG. 2, the touch screen **190** is disposed on a center of the front surface **100a** of the portable terminal **100**. The touch screen **190** has a large size to occupy most of the front surface **100a** of the portable terminal **100**. FIG. 2 shows an example where a main home screen is displayed on the touch screen **190** and is a first screen displayed on the touch screen **190** when power of the portable terminal **100** is turned on. Further, when the portable terminal **100** has different home screens of several pages, the main home screen may be a first home screen of the home screens of several pages. Short-cut icons **191-1**, **191-2**, and **191-3** are used for executing frequently used applications and a main menu icon **191-4**, time, weather for example may be displayed on the home screen. Further, a status bar **192** displays the status of the portable terminal **100** such as a battery charging status, a received signal intensity, and a current time.

The touch keys such as the home button **161a**, the menu button **161b**, the back button **161c** for example, may alternatively comprise mechanical keys, or a combination thereof may be formed below the touch screen **190**. Further, the touch keys may be a part of the touch screen **190**. When the home button **161a** is selected, the touch screen **190** displays a main home screen. For example, when the home button **161a** is pressed in a state where a menu screen or an application screen is displayed on the touch screen **190**, the main home screen is displayed on the touch screen **190**. That is, when the home button **161a** is touched while applications are executed on the touch screen **190**, the main home screen shown in FIG. 2 may be displayed on the touch screen **190**. In addition, the home button **161a** may be used to display recently used applications or a task manager on the touch screen **190**. The menu button **161b** provides a connection menu which can be used on the touch screen **190**. The connection menu includes a widget addition menu, a background changing menu, a search menu, an editing menu or an environment setup menu for example. The back button **161c** can be used for displaying the screen which was executed just before the currently executed screen or for terminating the most recently used application.

The first camera **151**, the illumination sensor **170a**, and the proximity sensor **170b** may be disposed on edges of the front surface **100a** of the portable terminal **100**. The second camera **152**, the flash **153**, and the speaker **163** may be disposed on a rear surface **100c** of the portable terminal **100**. For example, the power button **161d** and the volume buttons **161e** may be disposed on left and right side surfaces of the portable terminal **100**, and a terrestrial DMB antenna **141a** for broadcasting reception and the earphone connecting jack **167** may be disposed on an upper side surface. Further, one or a plurality of microphones **162** may be disposed on upper and lower side surfaces **100b** of the portable terminal **100**. The DMB antenna **141a** may be fixed to the portable terminal **100** or may be formed to be detachable from the portable terminal **100**. An earphone may be inserted into the earphone connecting jack **167**. Further, the connector **165** is formed in a lower side surface of the portable terminal **100**. A plurality of electrodes are formed in the connector **165** and may be connected with an external device through a wired cable.

FIG. 4 is a perspective view separately illustrating main components of the touch screen. As illustrated in FIG. 4, the touch screen **190** has a configuration in which a first touch panel **410** for detecting a finger input from a top to a bottom, a display unit **420** for a screen display, and a second touch panel **430** for detecting a stylus input are stacked close to each

other or sequentially stacked with an interval therebetween. The display unit **420** has a plurality of pixels and displays an image through the pixels. A Liquid Crystal Display (LCD), an Organic Light Emitting Diode (OLED), an LED for example may be used for the display unit **420**.

The first touch panel **410** includes a window **411** exposed through a front surface of the portable terminal **100** and a sensor layer **412** for detecting information (position, intensity for example) of a finger input, and the sensor layer **412** is deposited on a separate substrate over the window **411** or directly deposited on the window **411**. The first touch panel **410** may be constructed to provide the touch keys such as the menu button **161b**, the back button **161c** for example located below the screen exposed to the user. An upper surface of the window **411** is included in at least a part of the front surface of the touch screen **190** exposed to the outside. The window **411** may be formed with a transparent insulating material for visible light. Examples of the insulating material may include resin such as polyimide and polyethylene terephthalate or plastic.

A hard coating layer having high hardness is deposited on the upper surface of the window **411** to prevent a scratch and to improve the hardness and provide an antiglare function. For example, the hard coating layer may be formed with a material generated by adding light scattering agents to general hard coating agents. The sensor layer **412** includes a sensor for detecting a position when a passive user input means contacts a surface of the window **411** and has preset patterns for the detection. The sensor layer **412** may have various patterns such as a linear grid pattern, a diamond pattern for example, and the linear grid pattern is described as an example in the present embodiment. The sensor layer **412** may be deposited on a lower surface of the window **411** or a lower end (or lower surface) may be attached to an upper end (upper surface) of the display unit **420**.

FIG. 5 shows a diagram illustrating an example of a pattern of a sensor layer. The sensor layer **412** includes first electrode lines **510** and second electrode lines **520**. A cross-sectional view shown in a lower part of FIG. 5 illustrates the first electrode lines **510** TX1, TX2, and TX3 and the second electrode lines **520** RX. Each of the first electrode lines **510** extends in a first direction (for example, an x axis or a horizontal direction) and are disposed with an equal interval or different intervals in a second direction (for example, a y axis or a vertical direction) orthogonally crossing the first direction. Each of the second electrode lines **520** extends in the second direction orthogonally crossing the first direction and are disposed with an equal interval or different intervals in the first direction.

An insulating layer **530** is disposed between the first electrode lines **510** and the second electrode lines **520** to electrically insulate the first electrode lines **510** and the second electrode lines **520**. An insulating dielectric material such as SiO<sub>2</sub> for example may be used as a material of the insulating layer **530**. The sensor layer **412** is formed with a transparent conductive material for the visible light, and an example of the conductive material may include an organic material containing carbon such as carbon nanotube (CNT) or graphene. The sensor layer **412** may be formed through a process of forming a conductive thin film by a vacuum deposition process and then patterning the conductive thin film by a lithography process. An example of the vacuum deposition process may include E-beam, Sputtering, for example.

In order to perform a sensor function, a scan signal having a predetermined waveform is applied to the sensor layer **412**. When a first user input means contacts the surface of the window **411**, a detection signal waveform is changed due to

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capacitance between the sensor layer **412** and the first user input means. The controller **110** analyzes the detection signal and detects whether the first user input means contacts the surface of the window **411** and determines a contact position in the grid of first and second electrode lines **510** and **520**. For example, when the first user input means contacts the touch screen **190**, capacitance of a corresponding sensing point **540** increases. The controller **110** detects generation of a finger touch event based on a detection signal having a peak value equal to or larger than a threshold (or a minimum value equal to or smaller than the threshold) and also detects a finger input position. The threshold is a value by which a noise and a normal signal can be distinguished. The threshold is experimentally set, and may be set to have, for example, a voltage equal to or larger than 0 V or a capacitance value equal to or larger than 0 pF. Meanwhile, a finger is an example of the first user input means, and the first user input means has no limitation as long as it is a means which provides capacitance between the sensor layer **412** and the first user input means. Such means are collectively called passive or first user input means.

In order to perform the sensor function, voltages (that is, scan signals) having a predetermined waveform from the touch screen controller **195** are sequentially applied to the first electrode lines **510**, and the second electrode lines **520** and output detection signals in response to the scan signals are provided to the touch screen controller **195**. Points where the first and second electrode lines **510** and **520** cross are the sensing points **540**, and the sensing points **540** are disposed in a matrix structure in the present embodiment. That is, a finger input position is determined as one of positions of the sensing points **540**. When the first user input means contacts the surface of the window **411**, capacitance of the sensing points **540** is changed due to the capacitance between the sensor layer **412** and the first user input means. Due to the change in the capacitance, voltage waveforms of the detection signals output from the second electrode lines **520** are changed and an input position and/or an input intensity of the first user input means is detected in response to the detected changed voltage waveforms.

FIG. 6 shows a diagram of the second touch panel **430** comprising a touch panel of the Electromagnetic Resonance (EMR) type and includes first and second loop units **610** and **620**. The second touch panel **430** is operated by a control of the touch screen controller **195** and outputs detected signals to the touch screen controller **195**. The first loop unit **610** includes a plurality of first loops **611** and the second loop unit **620** includes a plurality of second loops **621**.

The first loop unit **610** and the second loop unit **620** may be disposed to be orthogonal to each other. The first loop unit **610** extends relatively long in a y axis in comparison with an x axis, and accordingly, is used to detect an x axis coordinate of a stylus input position. The second loop unit **620** extends relatively long in an x axis in comparison with a y axis, and accordingly, is used to detect a y axis coordinate of a stylus input position.

Each of the first and second loops **611** and **621** output a first signal of a fixed first frequency input in a form of an electromagnetic wave from the touch screen controller **195**. Further, the first and second loops **611** and **621** detect a second signal of a second frequency output in a form of an electromagnetic wave from a stylus corresponding to an active second user input means, and outputs the detected second signal to the touch screen controller **195**. The first frequency and the second frequency may be different from each other. The stylus located adjacent to the second touch panel **430** receives a first signal output in a form of an electromagnetic wave from the

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second touch panel **430** and in response generates a second or third signal in a form of an electromagnetic wave according to operation of a resonance circuit within the stylus. The stylus resonant circuit emits the generated second or third signal which is detected by coils **610** and **620**.

When the stylus does not contact the touch screen **190**, the stylus outputs a second signal of a fixed frequency. When the stylus contacts the touch screen **190**, the stylus outputs a third signal of a second or third frequency which changes in response to contact pressure. Alternatively, in one embodiment the stylus outputs a second signal of a fixed second frequency regardless of the contact between the stylus and the touch screen **190**. The stylus may output a third signal of a fixed second frequency including data indicating whether the stylus contacts the touch screen **190**. Further, the stylus is one embodiment, and other means can be used as a stylus if the means can output a second and/or third signals of the second and/or third frequency in response to an input of the first signal of the first frequency. The means may be collectively called the second user input means. The stylus includes a resonance circuit including a coil for detecting a position of the second touch panel **430** in the EMR type and a condenser.

FIGS. 7 and 8 show diagrams illustrating detection of a stylus input position where each of the first and second loops **611** and **621** is indicated by one line. The second loop **621** (hereinafter, referred to as a Y2 loop) emits a first signal in a form of an electromagnetic wave, and stylus **10** in response to the first signal, generates and emits a second signal in a form of an electromagnetic wave. The first loops **611** (hereinafter, referred to as X1, X2, and X3 loops) sequentially detect the second signal. The touch screen controller **195** derives an x axis coordinate of a stylus position in response to a peak or minimum value of an output of multiple output values provided by loops **611** derived in response to the second signal. Specifically, controller **195** derives an x axis coordinate of a stylus position in response to comparison of the peak value with a first threshold and comparison of the minimum value with a second threshold. For example, a threshold may be set as a voltage equal to or larger than 0 V or an electrical current value equal to or larger than 0 A.

Referring to FIG. 8, the first loop **611** (eg, an X2 loop) emits a first signal in a form of an electromagnetic wave, and the stylus **10** generates and emits a second signal in a form of an electromagnetic wave in response to the first signal. The second loops **621** (hereinafter, referred to as Y1, Y2, and Y3 loops) sequentially detect the second signal. The touch screen controller **195** derives a y axis coordinate of a stylus input position in response to a peak or minimum value of an output of multiple output values provided by loops **621** derived in response to the second signal. Specifically, controller **195** derives a y axis coordinate of a stylus position in response to comparison of the peak value with a first threshold and comparison of the minimum value with a second threshold.

FIG. 9 is a diagram illustrating a hover input. An input recognition distance as used herein comprises a maximum distance between a user input means (stylus or finger) and the touch screen **190** within which the controller **110** or the touch screen controller **195** can detect and output an input coordinate. An input recognition distance of the second touch panel **430** is larger than an input recognition distance of the first touch panel **410**. Since the first touch panel **410** has a relatively small input recognition distance (that is, the input recognition distance is about 0) Finger input touch detection by system **100** is limited to contact with the touch screen **190**. The second touch panel **430** in contrast, detects a stylus hover input and a stylus touch (contact) input.



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In response to a distance between the stylus **10** and the touch screen **190** being larger than 0 and ranges within the input recognition distance, the second touch panel **430** detects and outputs a second signal. In response to a distance between the stylus **10** and the touch screen **190** is 0, the second touch panel **430** detects and outputs a third signal. That is, the second touch panel **430** detects and outputs the second signal in response to a hover operation of a user, and detects and outputs a third signal in response to a touch operation of the user. For example, a stylus hover input and a stylus touch input is distinguished by existence or non-existence of pressure applied on the touch screen **190** by the stylus **10**. When the pressure is 0, the second touch panel **430** outputs the second signal. When the pressure is larger than 0, the second touch panel **430** outputs the third signal.

When a user makes a finger input using a finger **11** in a state comprising grasping the stylus **10**, the finger input may be ignored. Further, when the user makes a stylus input, a touch of a palm **12** may occur. The system distinguishes a finger input and a stylus input and an associated intention of the user. Inputs by parts of the body such as a finger, a palm for example are collectively called a finger input herein.

FIG. **10** shows a flowchart of a method of processing multiple touch inputs. In step **S1010** a hover input is detected. When the stylus enters within the input recognition distance of the second touch panel **430** on the surface of the touch screen **190** of the portable terminal **100**, the controller **110** detects a stylus hover input. That is, the controller **110** detects and recognizes a stylus hover event of a user in response to a detection value of the touch screen **190**. Specifically, the second touch panel **430** outputs a first signal of a fixed first frequency in a form of an electromagnetic wave and detects a second signal of a fixed second frequency output in a form of an electromagnetic wave from the stylus. The controller **110** detects generation of the stylus hover event in response to the second signal having a peak value equal to or larger than a threshold and also detects a stylus input position and/or intensity.

In step **S1020** a finger input is detected. When a user performs a finger touch while a stylus hover input is maintained, the controller **110** detects the finger input in response to a detection value of the touch screen **190**. That is, the controller **110** detects the finger touch (or palm touch) event based on the detection value of the touch screen **190**. Specifically, a scan signal is applied to the sensor layer **412** of the first touch panel **410** and the sensor layer **412** outputs a detection signal. The controller **110** detects generation of the finger touch event based on the detection signal having a peak value equal to or larger than a threshold and also detects a finger input position and/or intensity. In step **S1030** controller **110** calculates a distance between a hover input position and a finger input position.

FIGS. **11A** to **11C** show diagrams for describing a process of calculating a distance between a hover input position and a finger input position. FIG. **11A** shows a hover input pattern **1110** and a finger input pattern **1120** detected by the controller **110**, and the controller **110** calculates a distance between positions of the hover input pattern **1110** and the finger input pattern **1120**. The position of each of the patterns **1110** and **1120** are recorded using a center coordinate and an edge coordinate for example. A center coordinate of each of the patterns **1110** and **1120** indicates position of each of the patterns **1110** and **1120**. Alternatively, for example, when coordinates of the patterns **1110** and **1120** correspond to objects such as an icon or a touch key on the screen, the positions of the patterns **1110** and **1120** are determined by fixed coordinates of the objects such as center coordinates of

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the objects. The finger input pattern **1120** may be generated by a touch between the palm and the touch screen during a process in which the user attempts to perform a stylus input. The distance **D1** between the positions of the hover input pattern **1110** and the finger input pattern **1120** has a value larger than 30 mm.

FIG. **11B** shows a hover input pattern **1112** and a finger input pattern **1122** detected by the controller **110**, and the controller **110** calculates a distance **D2** between pattern **1112** and pattern **1122** positions. The finger input pattern **1122** is generated by a touch between the palm and the touch screen **190** in a state where the user grasps the stylus, for example. In this case, the distance **D2** between the positions of the hover input pattern **1112** and the finger input pattern **1122** has a value equal to or smaller than 30 mm.

FIG. **11C** shows a hover input pattern **1114** and finger input patterns **1124** and **1126** detected by the controller **110**, and the controller **110** calculates a distance **D3** between positions of the hover input pattern **1114** and the first finger input pattern **1124** and a distance **D4** between pattern **1114** and pattern **1126** positions. In this example, the finger input patterns **1124** and **1126** may be generated by a touch between two fingers (for example, a thumb and a middle finger) and the touch screen **190** is in a state where the user grasps a stylus. In this case, the distance **D3** between the positions of the hover input pattern **1114** and the first finger input pattern **1124** has a value equal to or smaller than 30 mm, and the distance **D4** between the positions of the hover input pattern **1114** and the second finger input pattern **1126** generally has a value larger than 30 mm. In such a multiple-touch occurrence, the controller **110** compares the distance **D3** which is shorter than the distance **D4** with a threshold. Controller **110** processes or ignores the detected first finger input pattern **1124** or pattern **1126** in response to comparison of **D3** and **D4** with one or more respective thresholds and in response to a relative comparison of **D3** and **D4**.

In step **S1040** controller **110** compares a calculated distance with a threshold. The threshold may be experimentally determined, and may be set as, for example, a value ranging from 20 mm to 40 mm or 30 mm to 50 mm. In step **S1050** controller **110** ignores the finger input when the calculated distance exceeds the threshold. For example, the finger input position may correspond to the short-cut icons **191-1**, **191-2**, and **191-3**, the main menu icon **191-4**, the home button **161a**, the menu button **161b**, the back button **161c**, and a menu within an application window, or may be associated with a selection of a position within the touch screen **190**. When the finger input is effective, the controller **110** performs a program operation corresponding to the finger input position. Controller **110** selects objects (application, menu, icon for example), executes objects and selects positions for example. When the finger input is ignored, the controller **110** does not perform the program operation corresponding to the finger input position but may indicate occurrence of the finger input for the user (for example, through a vibration, a sound, an indicator for example).

In step **S1060** controller **110** processes the finger input when the calculated distance is within the threshold. When the finger input is effective, the controller **110** performs the program operation corresponding to the finger input position, by selecting objects, executing objects, selecting positions for example. In response to concurrently receiving the finger input and the stylus input, controller **110** uses the previously described method to advantageously derive the intention of the user and processes the finger input in accordance with this intention.

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The apparatuses and methods of the disclosure can be implemented in hardware, and in part as firmware or as software or computer code that is stored on a non-transitory machine readable medium such as a CD ROM, a RAM, a floppy disk, a hard disk, or a magneto-optical disk or computer code downloaded over a network originally stored on a remote recording medium or a non-transitory machine readable medium and stored on a local non-transitory recording medium, so that the methods described herein are loaded into hardware such as a general purpose computer, or a special processor or in programmable or dedicated hardware, such as an ASIC or FPGA. As would be understood in the art, the computer, the processor, microprocessor controller or the programmable hardware include memory components, e.g., RAM, ROM, Flash, etc. that may store or receive software or computer code that when accessed and executed by the computer, processor or hardware implement the processing methods described herein. In addition, it would be recognized that when a general purpose computer accesses code for implementing the processing shown herein, the execution of the code transforms the general purpose computer into a special purpose computer for executing the processing shown herein. In addition, an artisan understands and appreciates that a "processor" or "microprocessor" constitute hardware circuitry in the claimed disclosure. Under the broadest reasonable interpretation, the appended claims constitute statutory subject matter in compliance with 35 U.S.C. §101 and do not constitute software per se.

It may be appreciated that the embodiments of the present invention can be implemented in software, hardware, or a combination thereof. Any such software may be stored, for example, in a volatile or non-volatile storage device such as a ROM, a memory such as a RAM, a memory chip, a memory device, or a memory IC, or a recordable optical or magnetic medium such as a CD, a DVD, a magnetic disk, or a magnetic tape, regardless of its ability to be erased or its ability to be re-recorded. It can be also appreciated that the memory included in the mobile terminal is one example of machine-readable devices suitable for storing a program including instructions that are executed by a processor device to thereby implement embodiments of the present invention. Therefore, embodiments of the present invention provide a program including codes for implementing a system or method claimed in any claim of the accompanying claims and a machine-readable device for storing such a program. Further, this program may be electronically conveyed through any medium such as a communication signal transferred via a wired or wireless connection, and embodiments of the present invention appropriately include equivalents thereto.

Further, the portable terminal can receive the program from a program providing apparatus connected to the portable terminal wirelessly or through a wire and store the received program. The program providing apparatus may include a memory for storing a program containing instructions for allowing the portable terminal to perform a preset content protecting method and information required for the content protecting method, a communication unit for performing wired or wireless communication with the portable terminal, and a controller for transmitting the corresponding program to the portable terminal in response to a request of the portable terminal or automatically.

While the present invention has been shown and described with reference to certain embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the present invention as defined by the appended claims.

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What is claimed is:

1. A method of processing a touch input by a portable terminal, the method comprising:

detecting a hover input of a stylus physically separated from a touch screen of the portable terminal without physical contact with the touch screen;

detecting a first touch input of a user's finger concurrent with the hover input, the finger being in physical contact with the touch screen;

calculating a first distance between positions of the hover input and the first touch input;

detecting a second touch input of the user's finger concurrent with the hover input, the finger being in physical contact with the touch screen;

calculating a second distance between positions of the hover input and the second touch input;

selecting a distance from the first distance and the second distance by comparing the first distance and the second distance;

comparing the selected distance with a predetermined threshold; and

performing one of:

(a) ignoring at least one of the first touch input and the second touch input in response to detecting the selected distance exceeds the threshold, and

(b) processing at least one of the first touch input and the second touch input, in response to detecting the selected distance is within the threshold.

2. The method of claim 1, further including selecting and executing an object corresponding to at least one of the first touch input and the second touch input.

3. The method of claim 1, wherein the selected distance is a length between the hover input and one of the first touch input and the second touch input.

4. A non-transitory machine-readable storage medium embodied with program instructions for causing a processor to execute a method in a device, the method comprising:

detecting a hover input of a stylus physically separated from a touch screen of the device without physical contact with the touch screen;

detecting a first touch input of a user's finger concurrent with the hover input, the finger being in physical contact with the touch screen;

calculating a first distance between positions of the hover input and the first touch input;

detecting a second touch input of the user's finger concurrent with the hover input, the finger being in physical contact with the touch screen;

calculating a second distance between positions of the hover input and the second touch input;

selecting a distance from the first distance and the second distance by comparing the first distance and the second distance;

comparing the selected distance with a predetermined threshold; and

performing one of:

(a) ignoring at least one of the first touch input and the second touch input in response to detecting the selected distance exceeds the threshold, and

(b) processing at least one of the first touch input and the second touch input, in response to detecting the selected distance is within the threshold.

5. A portable terminal comprising a non-transitory machine-readable storage medium embodied with program instructions for causing a processor to execute a method in a device, the method comprising:

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detecting a hover input of a stylus physically separated from a touch screen of the device without physical contact with the touch screen;

detecting a first touch input of a user's finger concurrent with the hover input, the finger being in physical contact with the touch screen; 5

calculating a first distance between positions of the hover input and the first touch input;

detecting a second touch input of the user's finger concurrent with the hover input, the finger being in physical contact with the touch screen; 10

calculating a second distance between positions of the hover input and the second touch input;

selecting a distance from the first distance and the second distance by comparing the first distance and the second distance; 15

comparing the selected distance with a predetermined threshold; and

performing one of:

(a) ignoring at least one of the first touch input and the second touch input in response to detecting the selected distance exceeds the threshold, and 20

(b) processing at least one of the first touch input and the second touch input, in response to detecting the selected distance is within the threshold. 25

6. A portable terminal for processing a touch input, the portable terminal comprising:

a touch screen configured to display input data and detect a hover input concurrent with a first touch input and a

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second touch input of a user's fingers being in physical contact with the touch screen, said hover input comprising at least one input of a stylus physically separated from the touch screen without physical contact with the touch screen; and

a controller configured to:

calculate a first distance between positions of the hover input and the first touch input in response to detection of the first touch input concurrent with the hover input;

calculate a second distance between positions of the hover input and the second touch input in response to detection of the second touch input concurrent with the hover input;

selecting a distance from the first distance and the second distance by comparing the first distance and the second distance;

compare the selected distance with a predetermined threshold; and

perform one of: (a) ignoring at least one of the first touch input and the second touch input in response to detecting the selected distance exceeds the threshold, and (b) processing at least one of the first touch input and the second touch input, in response to detecting the selected distance is within the threshold.

7. The portable terminal of claim 6, wherein the controller is configured to select and execute an object corresponding to at least one of the first touch input and the second touch input.

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